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ABSTRACT

This manual gives general information on seed treatment and type of seeds which can be treated. Also discussed are the problems and pests commonly associated with seed diseases and the fungicides and insecticides used for seed treatment. Information is also given on seed treatment equipment such as dust treaters, slurry treaters, and direct treaters, as well as on such procedures as labeling and coloring of treated seed. Finally, pesticide carriers, binders, stickers, and safety precautions are discussed. (BB)

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Applicator Training Manual for:

SEED TREATMENT PEST CONTROL

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UNIVERSITY OF KENTUCKY · COLLEGE OF AGRICULTURE · COOPERATIVE EXTENSION SERVICE
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CERTIFICATION OF PESTICIDE APPLICATORS SEED TREATMENT

Maintaining the quality of seed is dependent on many environmental factors, some of which are moisture, temperature, humidity, and storage conditions. Even though these factors are properly accounted for, seed quality may still be reduced by certain seedborne diseases or destroyed by insects and other pests. Research has shown that treating seed with one or more pesticides is the most economical and efficient way to protect seed from these pests and improve seed quality. Since pesticides are poisonous, extra care and safety precautions must be taken when applying them and in handling seed after it has been treated.

DEFINITION OF TREATED SEED

The term "treated" means "to give an application of a pesticide or subject seed to a process designed to reduce, control or repel disease organisms, insects, or other pests which attack the seed or seedlings."

SEEDS NORMALLY TREATED

The kinds of seeds that are normally treated with one or more pesticides are: corn, peanuts, cotton, sorghum, wheat, oats, rye, barley, millet, soybeans (under some conditions), pine tree and most vegetable seed.

PROBLEMS AND PESTS COMMONLY ASSOCIATED WITH SEED DISEASES

- Seed rot—rotting of seed before germination.
- Damping-off and seedling blight—soft rot of stem tissues near ground level and water soaking of seedling tissues.
- Seedling wilt—gray coloration starting at the leaf tips and extending rapidly to the whole leaf, causing complete collapse of seedlings in 24 to 48 hours.
- Root rot—water soaking, browning and sloughing of rootlets.
- Loose and covered smut of small grains.

The most common organisms usually associated with the above diseases are:

- Pythium species
- Fusarium
- Diploida
- Penicillium
- Helminthosporium
- Ustilago (smuts)
- Rhizoctonia

CEREAL GRAIN INSECTS

Rice Weevil:

Found in all grains, this pest is the most common and most destructive of the stored grain insects. A small snout beetle, it flies and sometimes infests grain in the field before harvest. The larva burrows into the heart of the kernel where it feeds and passes through the pupa stage. It emerges as an adult, cutting a small hole through the kernel, a "weevil exit-hole".

Granary Weevil:

This insect is very similar to the rice weevil and can only be distinguished from it by microscopic examination. It cannot fly.

Angoumois Grain Moth:

The adult is a dull gray. The larvae bore into the kernel, pass through the pupa stage, and emerge through a small round hole cut in the outer layer of the kernel. The moth breeds on the surface of the grain.

Lesser Grain Borer:

This is a small beetle, dark brown to black, with its head turned down under the front part of its body. It is a strong flier and can live under much drier conditions than most of the other stored grain insects.

Cadelle Beetle:

This is one of the largest stored grain insects and is black in color. The larvae burrow into the woodwork of bins and can stay there to infest new grain. These larvae are white in color with black heads and two horny black points at the ends of their bodies.

Saw-toothed Grain Beetle:

This is a reddish-brown to black insect which has 6 saw-toothed projections on each side of the front part of the body, visible under microscope.

Confused Flour Beetle:

The confused flour beetle, saw-toothed grain beetle and flat grain beetle are commonly referred to as "bran bugs." The confused flour beetle is reddish-brown and is one of the most common storage insects both in elevators and mills.

Flat Grain Beetle:

This is one of the smallest stored grain beetles. It is a flattened, oblong, reddish-brown beetle with antennae about 2/3 as long as the body.

Indian-meal Moth:

This moth has wings that have a reddish-brown, coppery luster on the outer two-thirds, with the rest light gray. The larvae may completely web over the surface of the infested grain. This moth is particularly common in corn storage and in packaged feed and meal.

PESTICIDE LABELS

Before using any pesticide, read and analyze the information on the label. The label contains detailed information about the product, including active ingredients, inert ingredients, a warning statement (such as: Danger–Keep Out of Reach of Children or Poison and Handle with Care), antidotes, the kind of seed to treat and rate per bushel, the kind of pests controlled, the necessary care in handling and use of the treated seed, and a disclaimer or warranty clause.

SEED TREATMENT FUNGICIDES

Fungicides are applied to seed prior to planting to provide effective protection against many seed- and soil-borne plant pathogens. Chemical (fungicide) treatment guards against the various seed rots and seedling blights that occur during storage or after planting. It is not usually a "cure-all" and will not provide disease protection throughout the growing season after the plants become self-sufficient. (An exception to this would be the control of loose smut by seed disinfection).

Fungicidal seed treatment may be divided into three categories, depending on the nature and purpose of the treatment. These categories are: (1) seed disinfection, (2) seed disinfestation, and (3) seed protection. A given fungicide may serve in one or more of these categories.

Seed disinfection–Disinfection is the elimination of a pathogen which *has penetrated* into living cells of the seed, infected it and become established–for example, loose smut of barley and wheat.

Seed disinfestation–Disinfestation is the control of spores and other forms of pathogenic organisms found *on the surface* of the seed.

Seed protection–Seed protection is chemical treatment to protect the seed and young seedling from pathogenic organisms in the soil.

Seed treatment materials are usually applied to seed in one of four forms: dust; slurries (a mixture of wettable powder in water); liquids; and planter-box formulations.

Based on composition, seed treatment fungicides may be organic or inorganic, metallic or non-metallic, and, until recently, mercurial or non-mercurial. Before the cancellation of the volatile mercurials, fungicides for treating seed were generally classified as volatile and non-volatile. With the elimination of the volatile mercurials, most fungicides now approved for use on seed are classified as non-volatile. When using this type material, complete coverage of the seed is necessary to obtain effective control.

Some of the systemics, a fairly new class of pesticides, may now be used as seed treatment materials. The desirability of having materials that would move inside the seed or plant and control the pest has long been recognized. Such materials are called "systemic." When used according to the manufacturer's recommendation (see label), a systemic moves through the host plant and controls or retards the growth of certain fungi and insects without affecting the host's metabolic system.

SEED TREATMENT INSECTICIDES

Insecticides are often applied to seed to control or reduce insect damage to seed during storage and, to a lesser degree, to prevent damage from such insects as wire worms and seed corn maggots in the soil.

For complete information on the chemical to use and the crop, insect or disease for which it provides control, refer to Extension publications PPA-6, *Seed Treatment for Grain*, or ENT-19, *Controlling Insects in Stored Grain*, both published by the Kentucky Cooperative Extension Service and available through your county Extension agent.

COMBINATIONS

Since some pesticides are selective in their control of pests, many times two or more compounds are combined in the treater tank, or an extra tank may be used, to give the spectrum of control needed.

The manufacturers of pesticides are now making combinations available to seed processors, but should a processor blend two or more pesticides, the compatability of the materials must be determined, since some combinations of materials may seriously reduce seed germination. Also, when applying two or more pesticides, even at different times, the sequence of application may be very important.

Whether a single pesticide or a combination is to be applied to the seed, read the label and follow the manufacturer's directions carefully.

SEED TREATING EQUIPMENT

Commercial seed treaters are designed to apply accurately measured quantities of pesticides to a given weight of seed. Basically, there are three types of commercial seed treaters on the market: dust treaters, slurry treaters, and direct treaters—the Panogen and Mist-O-Matic treaters are examples of direct treaters.

DUST TREATER

(Using Gustafson XL Dry Powder Seed Treater as an example)

Operation

Controlling the Flow of Seed:

The amount of seed which flows into the weigh pan (which is just beneath the feed hopper on top of the treater) is controlled by opening or closing the gates of the feed hopper by means of the hand wheel on the side of the hopper. The scale on the hopper shows how far the gates are open (in inches). Gates should be open to whatever number of inches it takes to keep the weigh pan filled to the required number of pounds per dump as it tilts in either direction. The number of pounds per dump is adjusted by correctly setting the counterweight up or down on the counterweight arm.

Powder Application:

To be sure that the correct amount of powder is being applied to the seed flow, a preliminary test must be made in which a given number of pounds of seed (such as 100 lbs) is run through the feeder.

During this run, the measuring cup provided with the feeder should be used to catch the powder as it comes off the vibrator. After the given amount of seed has run through, the powder should be weighed in order to determine how much is being applied to that amount of seed. The vibrator speed can then be adjusted accordingly. Then a second or more tests should be run until proper setting of the vibrator speed is determined for correct coverage.

Approximate Setting

No. Dumps	*Powder Scale Operating*	*Syntron Setting*	*Oz. Produced/100 lbs.*
25	1/2	60	2
25	3/4	60	5
25	3/4	70	6
25	3/4	80	7
25	1	60	10

Number 4 on counterweight arm gives five pounds per dump.

SLURRY SEED TREATER

The slurry treatment principle involves suspension of wettable powder treatment material in water. The treatment material applied as a slurry is accurately metered through a simple mechanism composed of a slurry cup and seed dump pan. The cup introduces a given amount of slurry with each dump of seed into a mixing chamber where they are blended.

While operation of the slurry treater is relatively simple, the various operation procedures must be thoroughly understood.

1. The metering principle is the same in direct, ready-mix or fully automatic treaters—i.e., the introduction of a fixed amount of slurry to a given weight of seed.
2. To obtain a given dump weight, slurry treaters are equipped with a seed gate that controls seed flow to the dump pan. With the proper seed gate setting, a constant dump weight for a given seed can be obtained.
3. The amount of treatment material applied is adjusted by the slurry concentration and the size of the slurry cup or bucket. As the dump pan fills, a point is reached where it over-balances the counter weight and dumps into the mixing chamber. This brings the alternate weighing pan in position to receive the inflow of seed and activates a mechanism to add a cup of slurry to the mixing chamber. Thus, one cup of slurry is added with each dump of seed.
4. The mixing chamber is fitted with an auger type agitator that mixes and moves seed to the bagging end of the chamber. The speed of the auger is important, because at slow speeds more uniform distribution is obtained.

Slurry tanks have 15 to 35 gallon capacities, depending upon the size of the treater. They are equipped with agitators that mix the slurry in the tank and keep it suspended during operation. It is important that the powder be thoroughly suspended in water before treating. If the treater has been idle for any period of time, sediment in the bottom of the slurry cups must be cleaned out.

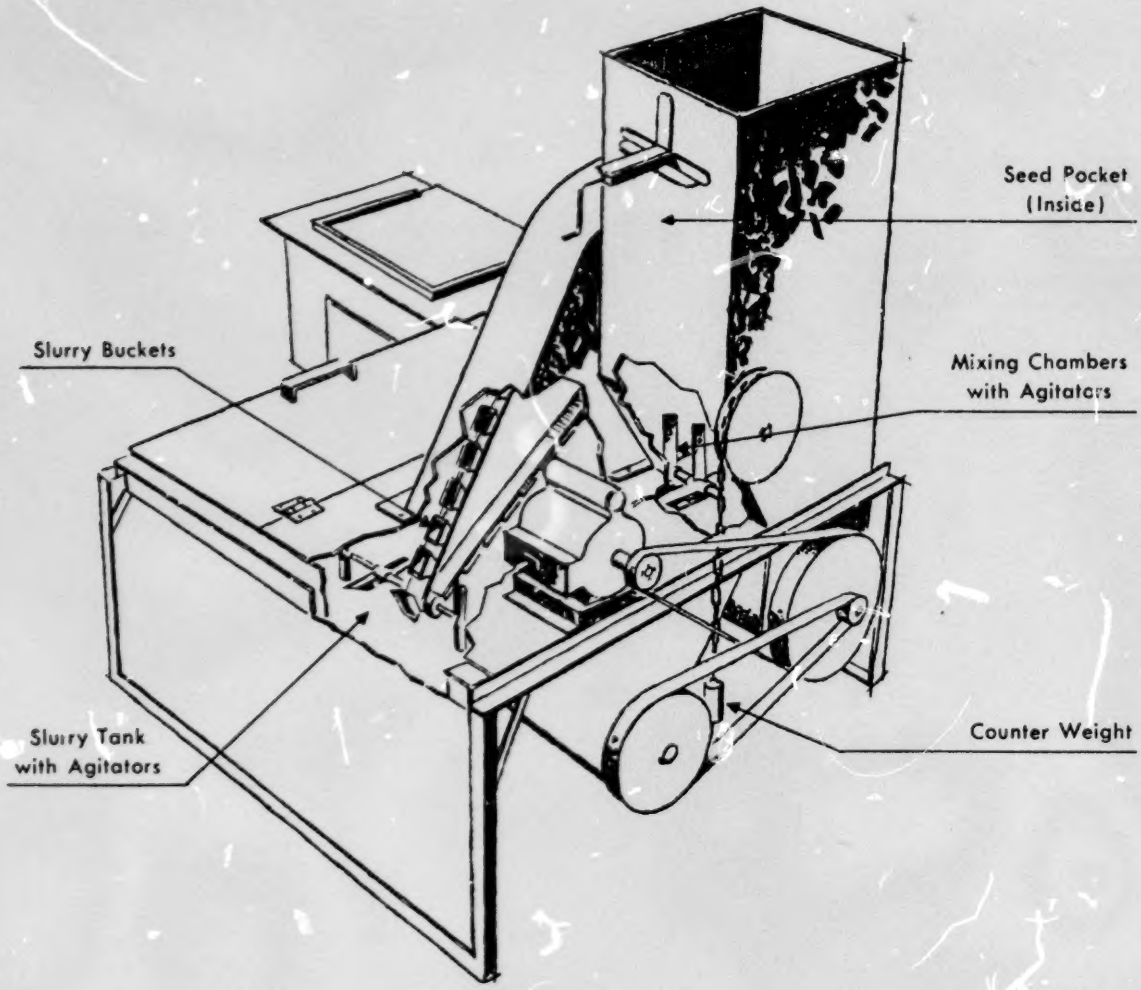

Fig. 1: Slurry Seed Treater

The proper size slurry cup must be used. Most machines now have cups with ports and rubber plugs for 15 cc, 23 cc, and 46 cc quantities. Some users prefer to mix the slurry in an auxiliary tank and then transfer to the slurry chamber as needed.

DIRECT TREATERS

Direct treaters are the most recent development and include the Panogen and Mist-O-Matic treaters. These two were initially designed to apply undiluted liquid treatment. Instead of applying 23 cc of material per 10 pounds of wheat, as in slurry treaters, they apply 14 to 21 cc (1/2 to 3/4 ounces) per bushel of wheat. This small quantity of material is suitable only with liquid materials which are somewhat volatile and do not require complete, uniform coverage for effective action.

Later modifications for direct treaters include dual tanks that permit simultaneous addition of a fungicide and an insecticide, and adaptations for the application of slurries. The metering device used

in both types of direct treater is similar to that of the slurry treater, since it is attained through synchronization of a treatment cup and seed dump. Otherwise, the two direct treaters differ decidedly from the slurry treater and from each other. Both of these direct treaters have an adjustable dump pan counter weight to adjust the weight of the seed dump. This is not practical with slurry treaters.

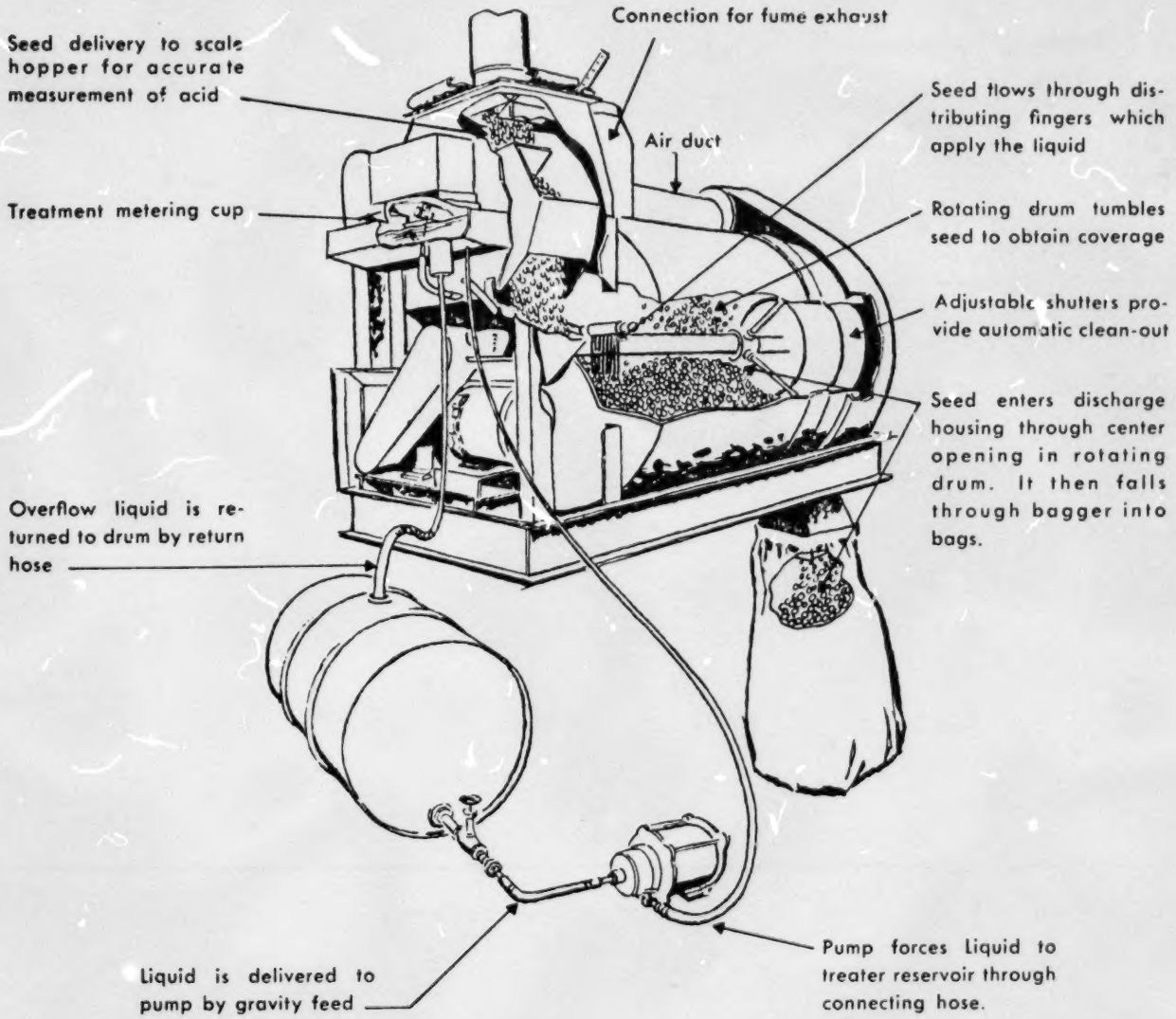
Connection for fume exhaust
Seed delivery to scale hopper for accurate measurement of acid
Air duct
Seed flows through distributing fingers which apply the liquid
Treatment metering cup
Rotating drum tumbles seed to obtain coverage
Adjustable shutters provide automatic clean-out
Seed enters discharge housing through center opening in rotating drum. It then falls through bagger into bags.
Overflow liquid is returned to drum by return hose
Liquid is delivered to pump by gravity feed
Pump forces Liquid to treater reservoir through connecting hose.

Fig. 2: Panogen Seed Treater

Panogen Seed Treater:

The operation of the Panogen treater is relatively simple. A small treatment cup, operating from a rocker arm directly off the seed dump pan and out of a small reservoir, meters one cup of treatment with each dump of the seed pan. Fungicide flows through a tube to the head of the revolving drum

seed mixing chamber. It flows in with seed from the dumping pan and is distributed over the seed by the rubbing action of the seed passing through the revolving drum.

The desired treating rate is obtained by the size of the treatment cup and by adjusting the seed dump weight. Treatment cup sizes are designated by treating rate in ounces and not by actual size—e.g., the 3/4 ounce cup applies 3/4 ounce (22.5 cc) of treatment per bushel with six dumps per bushel. The actual size of this cup is approximately 3.75cc.

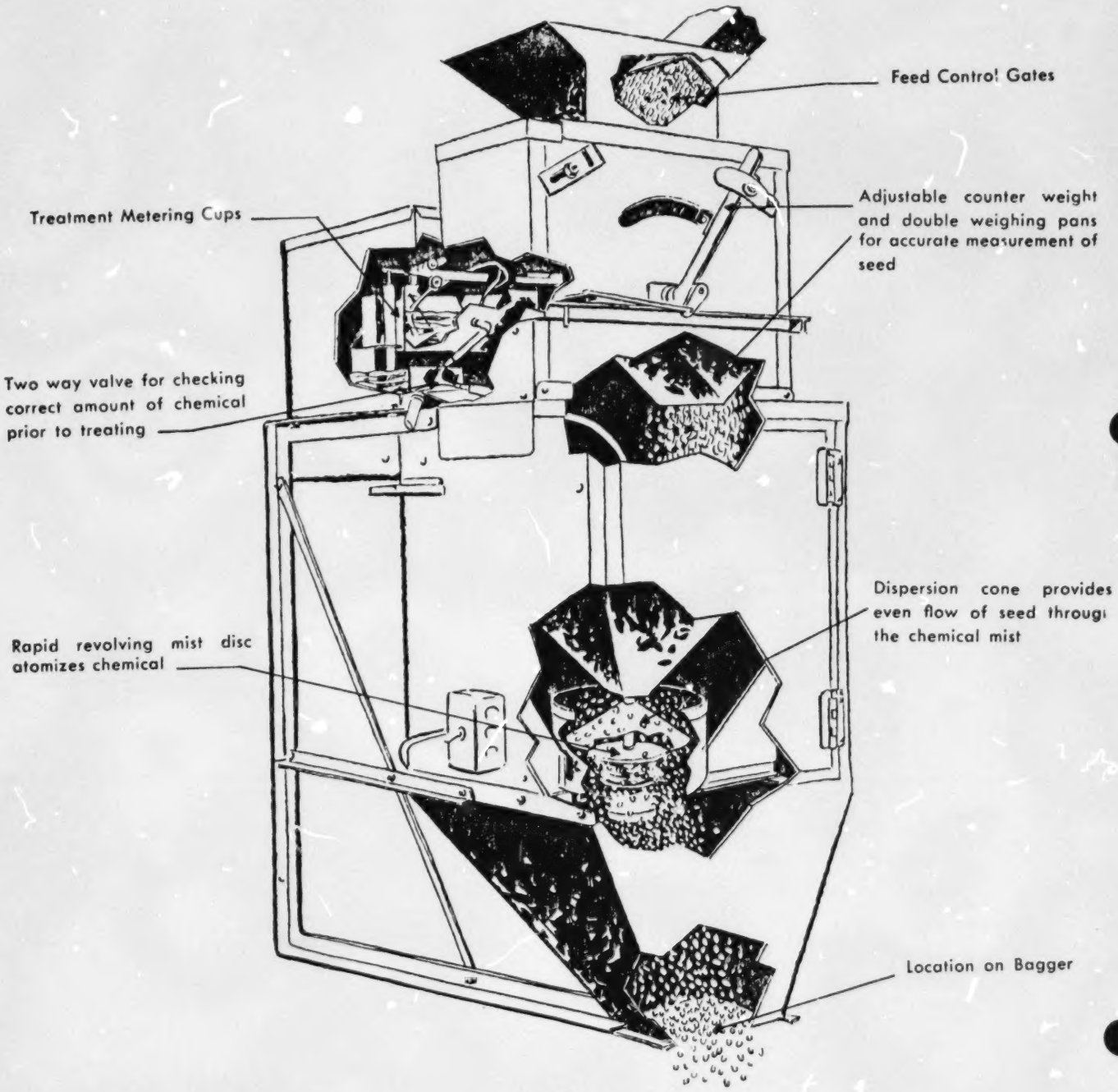
Feed Control Gates
Adjustable counter weight and double weighing pans for accurate measurement of seed
Treatment Metering Cups
Two way valve for checking correct amount of chemical prior to treating
Dispersion cone provides even flow of seed through the chemical mist
Rapid revolving mist disc atomizes chemical
Location on Bagger

Fig. 3: Mist-O-Matic Seed Treater

Mist-O-Matic Seed Treater:

The "mist-o-matic" treater applies treatment as a mist directly to the seed. The metering operation of the treatment cups and seed dump is similar to that of the "Panogen" treater. Cup sizes are designated by the number of cc's they actually deliver—e.g., 2½, 5, 10, 20 and 40. The treater is equipped with a large treatment tank, a pump and a return that maintains the level in the small reservoir from which the treatment cups are fed. After metering, the treatment material flows to a rapidly revolving, fluted disc mounted under a seed-spreading cone. The disc breaks droplets of the treatment into a fine mist and sprays it outward to coat seed falling over the cone through the treating chamber. Just below the seed dump are two adjustable retarders designed to give a continuous flow of seed over the cone between seed dumps. This is important since there is a continuous misting of material from the revolving disc. The desired treating rate is obtained through selection of treatment cup size and proper adjustment of the seed dump weight.

CALIBRATING A SLURRY OR LIQUID SEED TREATER FOR THE CORRECT DOSAGE

1. Determine how much liquid your treater's metering cup or bucket will dump into the seed each time the weighted seed pan trips. Record for future use.
2. Run seed slowly into the treater until the weighted seed plan dumps seed into the treater. Shut off the feed to the treater immediately. Weigh the amount of seed dumped into the treater. Record the setting of the weight on the weight balance arm and the weight of the grain dumped and keep this record for future use.
3. Determine the number of dumps per bushel by dividing the weight per dump into the bushel weight of your seed. For example, a treater dumps 6 pounds of wheat each time the seed pan trips. Dividing 60 pounds per bushel by 6 gives 10 dumps per bushel.
4. Determine how much of the liquid or slurry you are applying per bushel of seed. To do this, multiply (1 above) the amount of chemical your metering cup dumps into the seed by (3 above) the number of dumps per bushel. Since most metering cup capacities are measured in cc while the chemical recommendations are in ounces per bushel, divide the result by 29.57 to give the liquid ounces per bushel applied:

$$\frac{\text{Metering cup capacity in cc}}{29.57\text{ cc}} \times \text{Number of dumps per bushel} = \text{ounces of liquid applied per bushel.}$$

$$\text{For example: } \frac{46\text{ cc} \times 10\text{ dumps}}{29.57} = \frac{460}{29.57} = 15.6\text{ oz. liquid per bushel.}$$

5. To determine the correct amount of powdered chemical to add to one gallon of water for a slurry mixture, divide 128 by the number of ounces of liquid applied per bushel and multiply the result by the ounces of the chemical you want to apply to one bushel:

$$\frac{\text{128 ounces per gallon}}{\text{Oz. liquid applied/bu.}} \times \text{Oz. powdered chemical desired/bushel} = \text{Ounces of slurry to add to one gallon of water}$$

$$\text{For example: } \frac{128}{15.6} \times 1.5 = 12.3\text{ ounces powdered chemical to add to one gallon of water.}$$

Note: For additional information see the calibration instruction manual furnished with each machine by the manufacturer.

REQUIREMENTS UNDER THE FEDERAL AND KENTUCKY SEED LAW FOR LABELING OF TREATED SEED*

Information required to be shown on the label:

1. A word or statement in type no smaller than 8 points indicating that the seed has been treated.
2. The commonly accepted, coined, chemical or abbreviated chemical (generic) name of the applied substance and the rate of application.
3. A caution statement if the substance used in such treatment in the amount remaining with the seed is harmful to humans or other vertibrate animals.
4. Seed treated with a mercurial or similarly toxic substance shall be labeled to show a statement such as "poison treated" in red. In addition, the label shall show a representation of a skull and crossbones (see figure).
5. Seed treated with less toxic substances, if the amount remaining with the seed is harmful to humans or other vertibrate animals, shall be labeled to show a caution statement in type no smaller than 8 points, such as "Do Not Use for Food, Feed, or Oil." (See figure).
6. The information shown in Figs. 4 and 5 represents minimum labeling requirements and the label may contain additional information such as purpose of treatment, antidotes, safety precautions, and procedure to follow in case of an accident.

**For complete instructions on labeling treated seed in Kentucky, refer to the Kentucky Seed Law and regulations thereunder, available at the Division of Regulatory Services, University of Kentucky, Lexington, Ky. 40506.*

POISON TREATED

POISON

CAUTION

DO NOT USE THIS SEED FOR FOOD OR FEED OR OIL PURPOSES

POISON

XXX DO NOT DUMP UNUSED SEED OR CONTAINER, TO DISPOSE BURY 18 INCHES DEEP XXX

LIST NAME OF MATERIAL AND RATE

Fig. 4: Sample Label for Mercurials or Similarly Toxic Substances

T R E A T E D

List

Name of

Material

and rate

WARNING
DO NOT USE FOR FOOD,
FEED OR OIL PURPOSES.

Fig. 5: Sample Label for Less Toxic Substances

COLORING GRAIN SEED TREATED WITH POISONOUS SUBSTANCES

All interstate shipments of the food seeds—wheat, corn, oats, rye, barley and sorghum—bearing a poisonous treatment in excess of a recognized tolerance or treatment for which no tolerance or exemption from tolerance is recognized, must be denatured by a suitable color to prevent their use as food, feed or oil.

Many of the pesticides now come from the manufacturer with the dye or color added as a convenience to the operator; however, some seed processors prefer to mix the dye with the pesticide at the plant so that the desired color may be obtained. Most all treated seed are now colored, with the dye causing no apparent injury to seed germination or danger to personnel processing or using the seed. Exceptions to this are products bearing directions for use solely as planter-box treatments.

PESTICIDE CARRIERS, BINDERS AND STICKERS

These materials are listed on the label as inert ingredients. There is no requirement that the name of these materials be given. They are selected by the manufactory and are usually neutral in pH, non-toxic to humans and cause no apparent damage to the germination of the seed.

SAFETY PRECAUTIONS

Hazards associated with handling, sorting, mixing and storage of treated seed can be minimized by following these safety precautions:

1. Read the label and follow instructions carefully as over-treatment may injure the seed and under-treatment will not control the pest.

2. When handling chemicals which are labeled as being toxic substances, the operating personnel may need protective clothing as indicated on the label. Such clothing may include: (a) coveralls, (b) cap, (c) protective glasses, (d) rubber apron, (e) rubber boots, (f) rubber gloves, and (g) a respirator designed for use with the material. Personnel should not inhale the dust or vapor nor permit the material to contact the skin or eyes. The operator should wash thoroughly with soap and water before eating and smoking. Bathe immediately after work and change all clothing. Wash clothing thoroughly with soap and hot water before re-use. In case of contact, immediately remove contaminated clothing and wash skin thoroughly with soap and water.
3. A shower should be installed in the immediate vicinity of the treater.
4. An exhaust system should be installed to remove vapors and dust from the operating area. The exhaust air should discharge into a cyclone or bag-type dust collector. The treater should also be vented and tied into the exhaust system.
5. Seed treaters should be isolated and confined to the seed processing area of the building and should not be operated in areas where other farm commodities that are used for food, feed or oil are stored, handled or distributed.
6. Special multiwall (3 or 4 ply) or tightly woven bags are recommended for seed that has been treated.
7. Store treated seed in a dry, cool place away from food or feed products.
8. Seed treaters and treating equipment should be thoroughly cleaned after use, since some of the pesticides are corrosive and others settle out and cause clogging of the equipment. Do not run contaminated water into a stream or public sewer, but discharge contaminated water into a shallow ground pit.
9. All pesticides and chemicals used for seed treatment should be stored in a separate, enclosed but ventilated room which is readily accessible only to authorized operators.

Hazards associated with the use of treated seed and the disposal of unused treated seed and empty pesticide and treated seed containers can be minimized by following these precautions:

1. The user of treated seed should read and follow the label carefully.
2. Planter hoppers should be filled out of doors.
3. Do not breathe dust or fumes from treated seed or allow it to get in your eyes or on your skin. Wash thoroughly with soap and warm water after handling treated seed.
4. Use treated seed for seed and do not introduce it into food and feed channels. Doing so may cause serious injury to poultry, livestock ahd humans.
5. Do not re-use pesticide containers. Destroy them by puncturing and crushing them and then burying them at least 18 inches deep in an isolated area away from water supplies. *Note:* When disposing of 55 gallon drums, follow manufacturer's recommendation for decontamination and container disposal.
6. Empty treated seed containers and low germinating seed should both be destroyed by burying them at least 18 inches deep in an isolated area away from water supplies. *Note:* treated seeds exposed on soil surface will be hazardous to birds and wildlife.

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